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Southern Cone Rust

By George H. Hepting, forest pathologist,
Southeastern Forest Experiment Station

A rust disease that can completely destroy newly formed cones of slash and longleaf pine has attracted attention frequently since its discovery in Florida in 1892. Its attack has periodically been severe enough to materially reduce cone crops, particularly those of slash pine, in south Georgia, north Florida, and along the coast of the Gulf of Mexico. As long as the slash pine seed supply was more than ample for natural regeneration and for the needs of nurseries and direct seeding in the field, the cone rust was not an economic problem. However, since the demand for seed is now often greater than the supply and since in specific areas, such as those termed seed production areas and orchards, seed is the main crop, this rust has recently assumed major importance.

Symptoms and Damage

The disease becomes evident in the new conelet shortly after pollination. The affected conelets increase rapidly in size so that by the latter part of March they are usually 3 or 4 times larger than healthy ones (fig. 1), and their scales have a reddish color. During spring, nectar-loving insects gather about diseased cones and feed upon a sweet liquid exuded by the infected swollen cones. In late spring, the diseased cones become yellow because of the great quantities of fungus spores produced, and at this stage they can be identified as far as they can be seen (fig. 2). The diseased cones then fall, and practically all are shed by late summer. Diseased cones are usually heavily attacked by insects, particularly of the genus *Dioryctria*, which can multiply in them and then attack healthy cones.

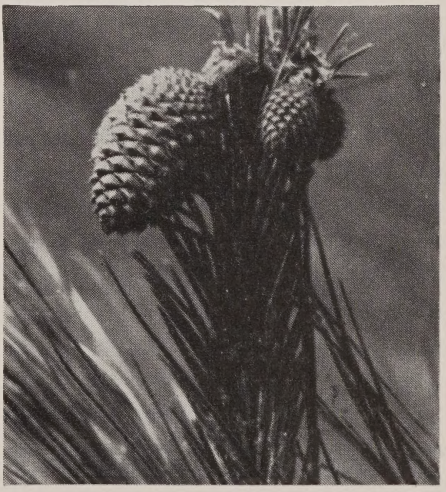

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Figure 1.—Large slash pine cone on left is rust infected. Small cones on right are healthy.

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Heavy cone losses from rust have been reported from time to time. In 1919 between 25 and 90 percent of the slash and longleaf cone crop was destroyed in areas near Dunedin, Fla. In 1950 half the cones were destroyed in a sample area in south Georgia. In 1956 there were reports of heavy losses in Florida. In 1957 a survey showed an average loss of 18 percent of the slash pine cones in south Georgia and Florida, with losses approaching 100 percent in some areas. These are merely examples of measured cone rust losses. The rust has caused heavy damage in many other years, along the Mississippi and Alabama Gulf Coast as well as farther east.

Cause

The fungus *Cronartium strobilinum* causes southern cone rust. Sporidia of this fungus, which are produced on oak leaves, infect the mature female pine flowers about the time of pollination. The fungus grows through the developing conelet, causing it to swell. In early spring, pycniospores exude from infected cones in viscid droplets. Between early March and mid-June, or occasionally later, cavities in the cones caused by the fungus burst; the cone scale tissue above them sloughs off; and masses of yellow aeciospores are exposed to be distributed by wind and rain.

The aeciospores infect the leaves of many species of oak. The next stage, produced also on oak leaves, is the uredo stage and can be observed as small, yellow, powdery pustules on the undersides of the leaves. Uredospores infect additional oaks and build up the rust enormously during summer and fall. When the leaves of the deciduous oaks fall in autumn, they probably present no hazard to the pines. But on the leaves of evergreen oaks such as live oak (*Quercus virginiana*), running oak (*Q. pumila*), and sometimes water oak (*Q. nigra*) or other oaks in Florida, the fungus produces a telial stage. The hairlike, telial spore horns mature on the underside of the leaves during the winter and produce the sporidia that infect the mature female pine flowers sometime between mid-December and the end of February. When maturing female pine flowers were bagged between January 9 and February 20, no cones rusted, as compared with considerable infection of unbagged flowers. These observations help to establish the period of conelet infection.

The incidence of cone rust in any given year depends upon many factors, and conditions pertaining to all of these factors must be favorable to the rust for an epidemic to result. Cone rust can become severe only (1) if air moisture and temperature conditions during the summer and fall result in a buildup of the rust on the evergreen oaks, (2) if suitable weather conditions promote the development of viable telia in the winter, and (3) if there is enough atmospheric moisture and suitable air temperature so that sporidia are produced on the telia and are carried to the maturing flowers, where they germinate and

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Figure 2.—Slash pine: The 5 smaller cones are healthy; the 6 larger are rust diseased. Surface irregularities of the diseased cones indicate production of spores.

infect. While we do not yet know the particular air temperature and moisture conditions that are essential to each stage of development of the rust, recent experience and experiments with white pine blister rust, a disease with a similar life cycle, have shown the importance of local weather factors on rust damage.

Control

Cone rust has been completely prevented by bagging immature female slash pine flowers, in connection with artificial pollination. This control measure is helpful in eliminating interference from the rust in pine breeding.

No control measures have yet been devised for cone rust suitable for general field use. Research specifically on control is now under way. The program has two main aspects: (1) to determine if one or two fungicidal sprays, properly timed, will prevent the rust when applied to pines as the female flowers are maturing, and (2) to determine for what distance it would be necessary to eliminate or temporarily defoliate evergreen oaks to protect seed orchards or seed production areas from rust.

Until control measures have been worked out, any persons planning slash pine seed orchards in south Georgia, Florida, and the Gulf

Coast of Alabama and Mississippi may do well to avoid establishing them near the coast, near swamps or other humid areas, or where evergreen oaks are common near the proposed site.

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